



Saccharide-based Approach to Green Metallic Nanostructure Synthesis

Engelbrekt, Christian; Sørensen, Karsten Holm; Jensen, Palle Skovhus; Ulstrup, Jens; Zhang, Jingdong

Publication date:
2011

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Engelbrekt, C., Sørensen, K. H., Jensen, P. S., Ulstrup, J., & Zhang, J. (2011). *Saccharide-based Approach to Green Metallic Nanostructure Synthesis*. Poster session presented at Nanoday 2011, Lyngby, Denmark.

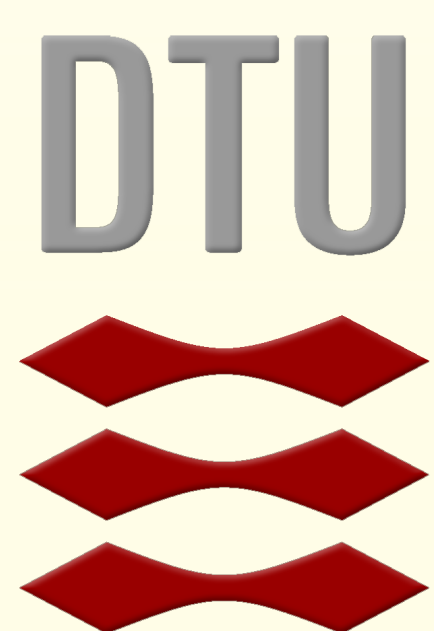
General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Saccharide-based Approach to Green Metallic Nanostructure Synthesis



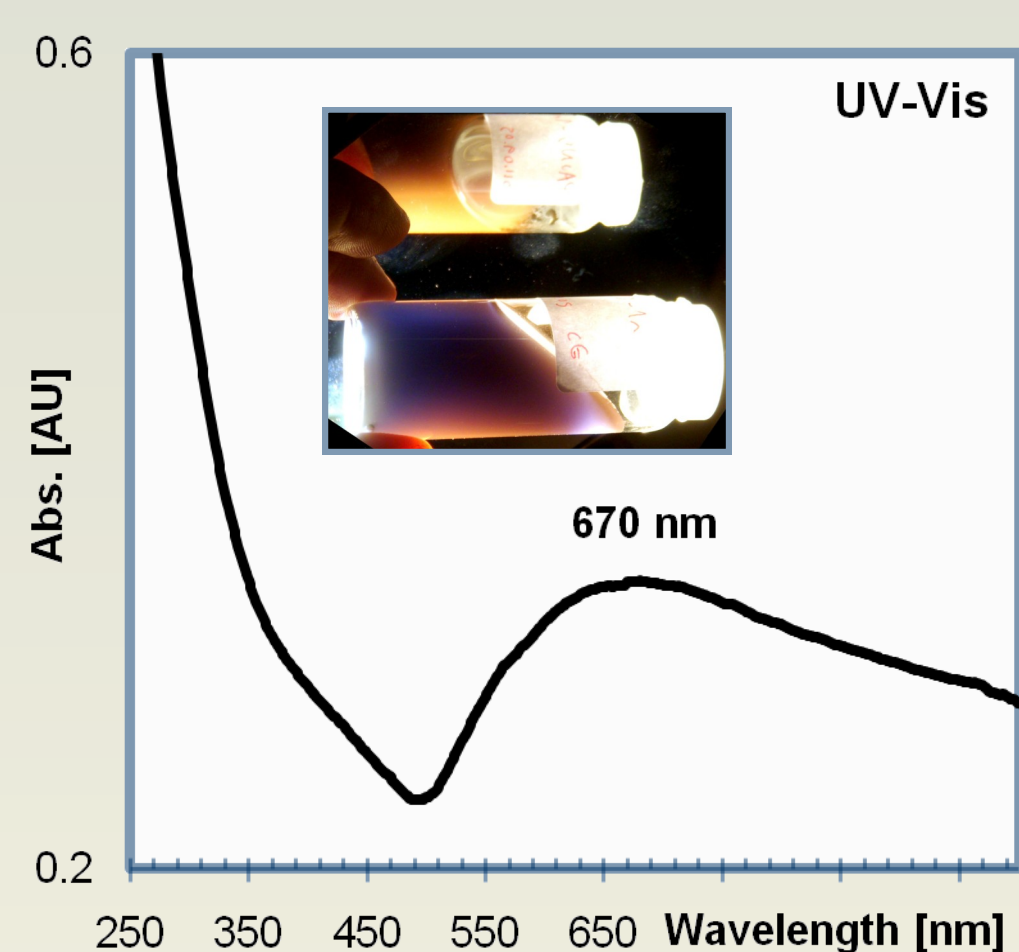
Christian Engelbrekt, Karsten H. Sørensen,
Palle S. Jensen, Jens Ulstrup and Jingdong Zhang

DTU Chemistry, NanoDTU, Technical University of Denmark
DK-2800 Kgs. Lyngby, Denmark; cheng@kemi.dtu.dk

$$pH = -\log\{H^+\} \int_a^b \Theta + \Omega \int \delta e^{i\pi} = - \frac{\sqrt{17}}{[2.7182818284]^9} \sum_{x=1}^{\infty} \frac{1}{x!}$$

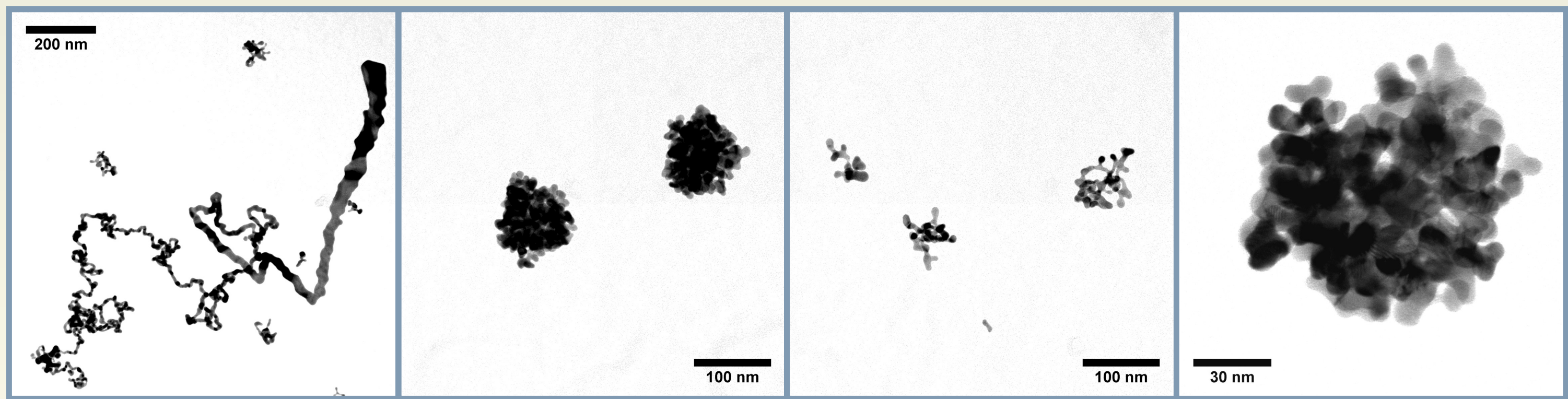
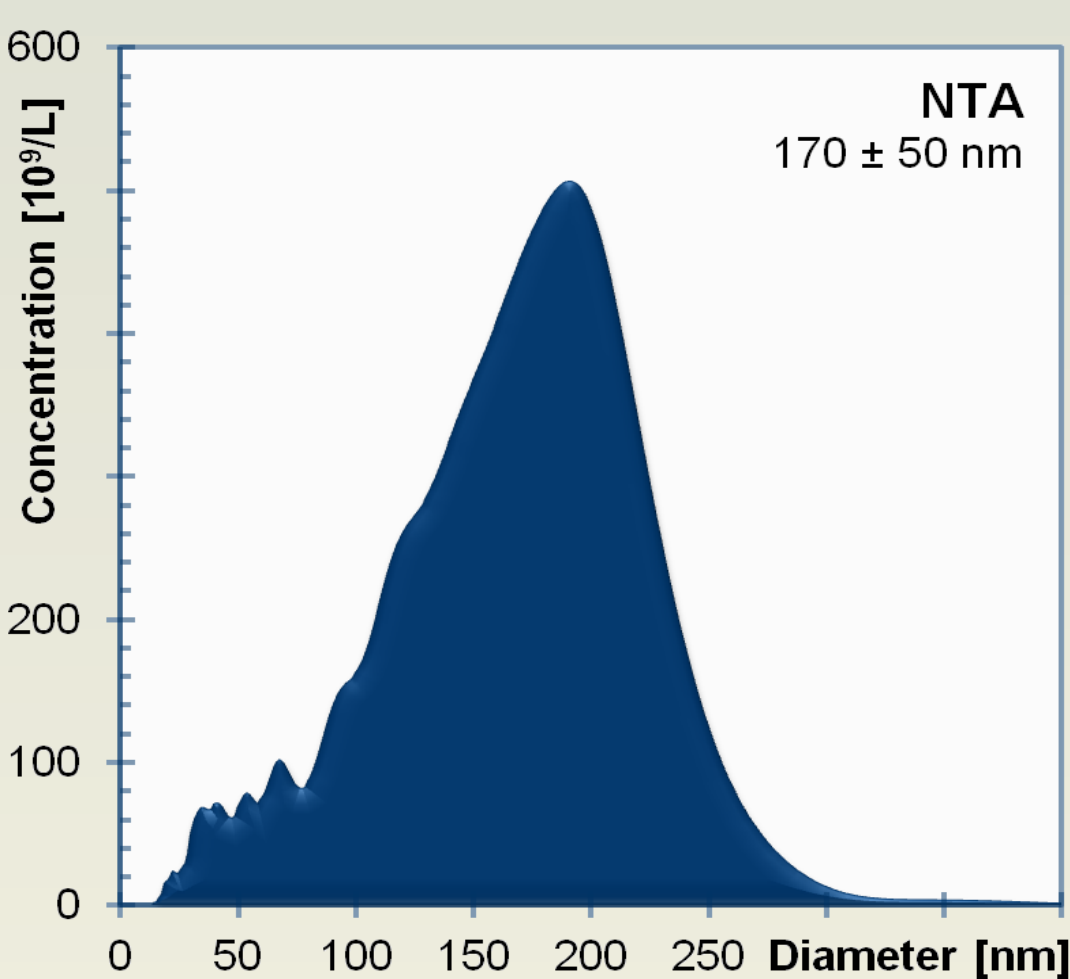
A green approach to solution synthesis of metallic nanoparticles has been developed using harmless and bioapplicable chemicals as well as moderate temperatures. Metal precursors are reduced by glucose/buffers and sterically stabilized by starch. The saccharide based procedure is highly diverse producing specifically a wide range of spherical, anisotropic, metallic, semi-conductor and core-shell nanostructures.

NOVEL TYPE ANISOTROPIC METALLIC NANOSTRUCTURES



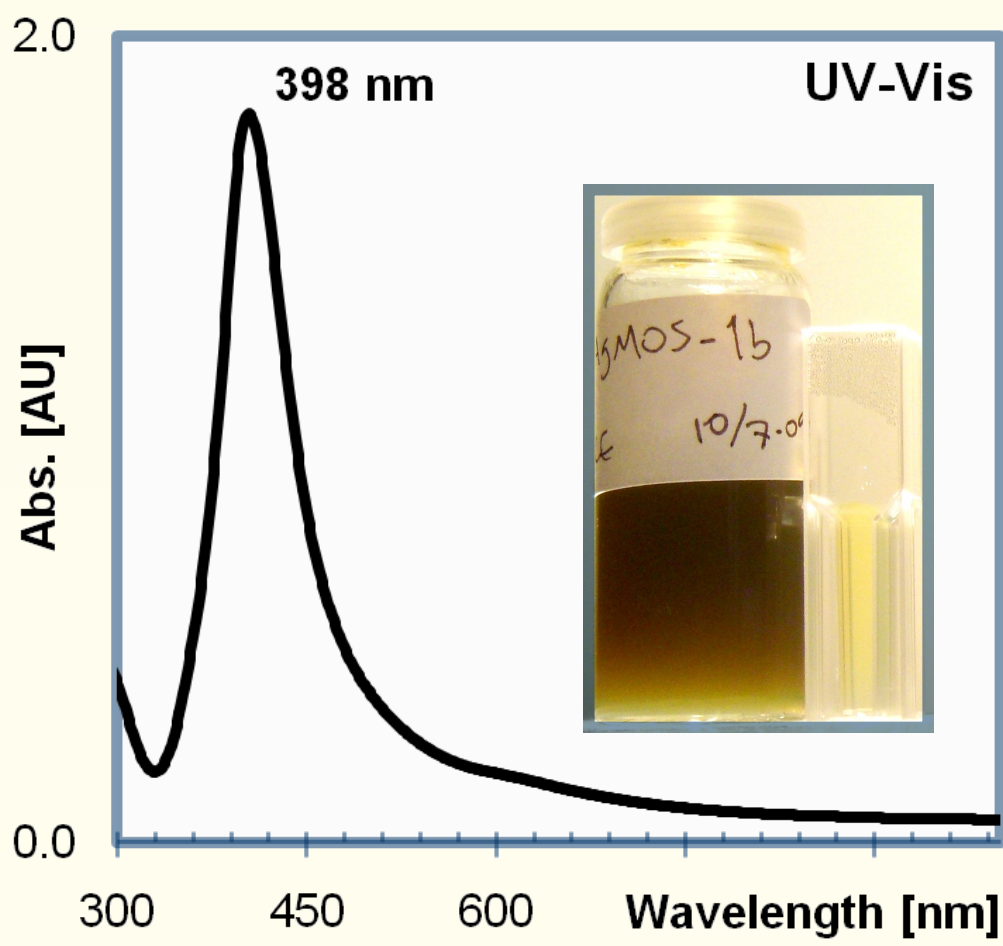
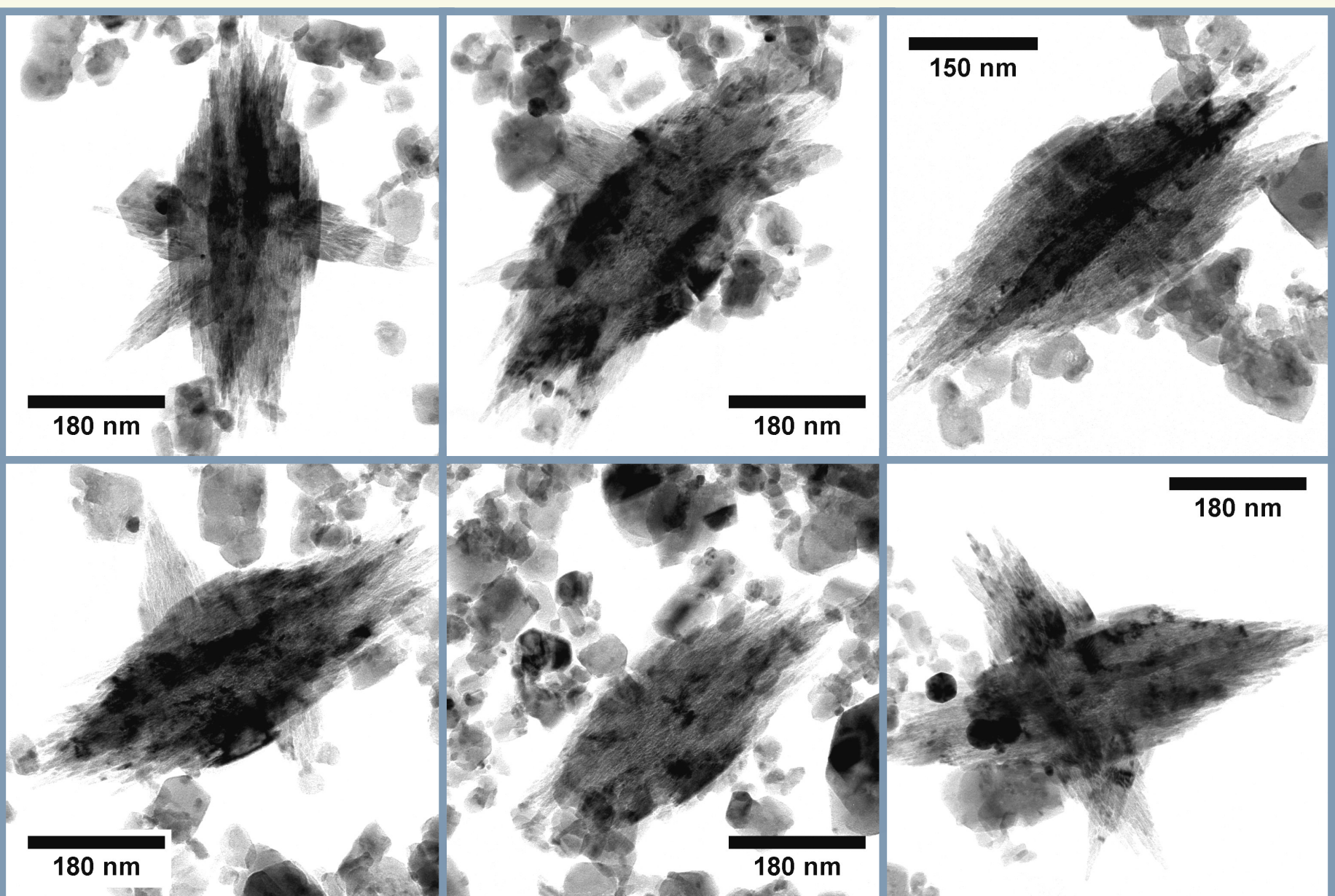
GOLD NANO-DENDRITES

Dendritic/porous nanostructures of gold are prepared by slow reduction/growth. The structures are 100-200 nm in diameter with a very large surface area.



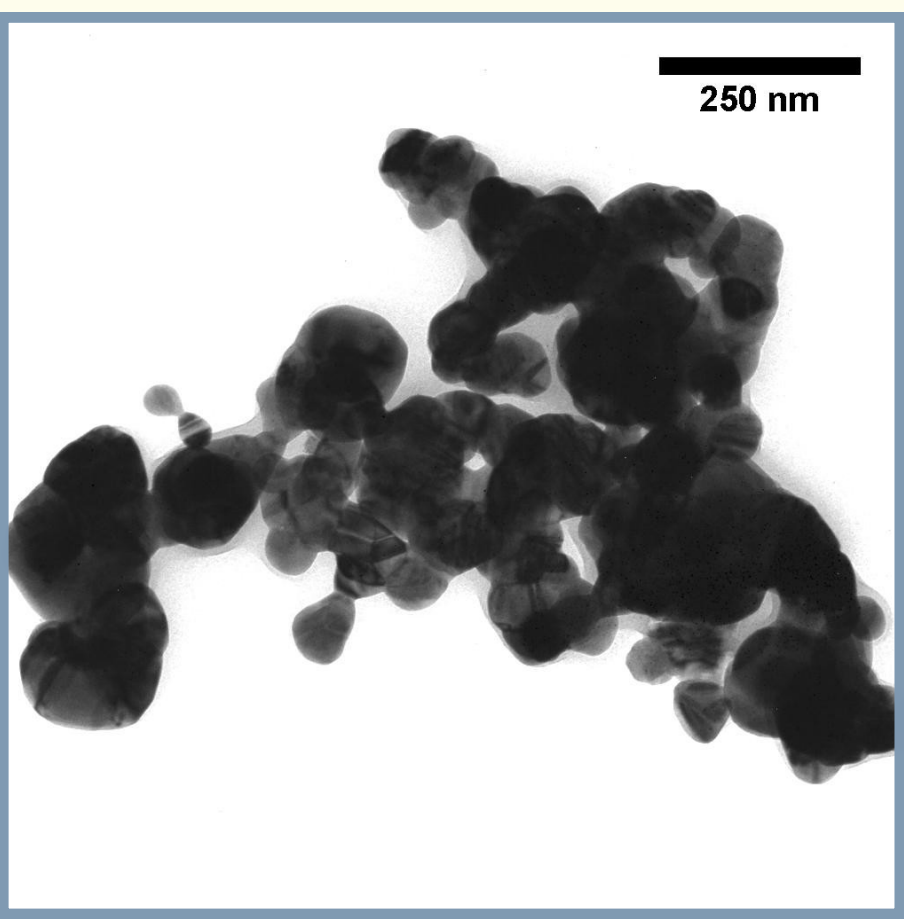
CUPRIC OXIDE NANOSHUTTLES

Clusters of crystalline bundles of needle-shaped CuO as well as cubic CuO NPs are obtained.

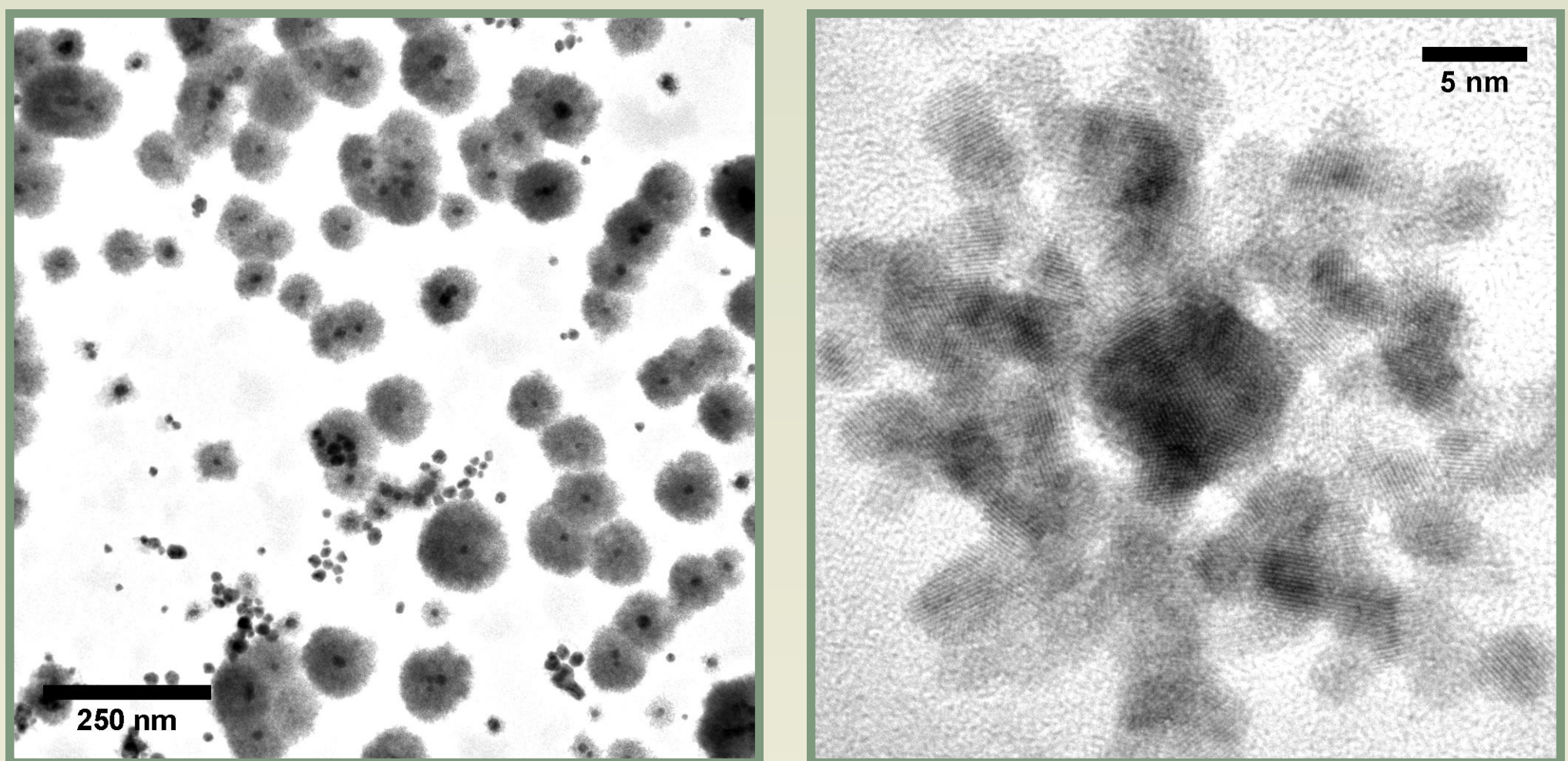


SILVER NANO-CLUSTERS

Clusters of sintered, polydisperse, spherical silver nano-particles are prepared.



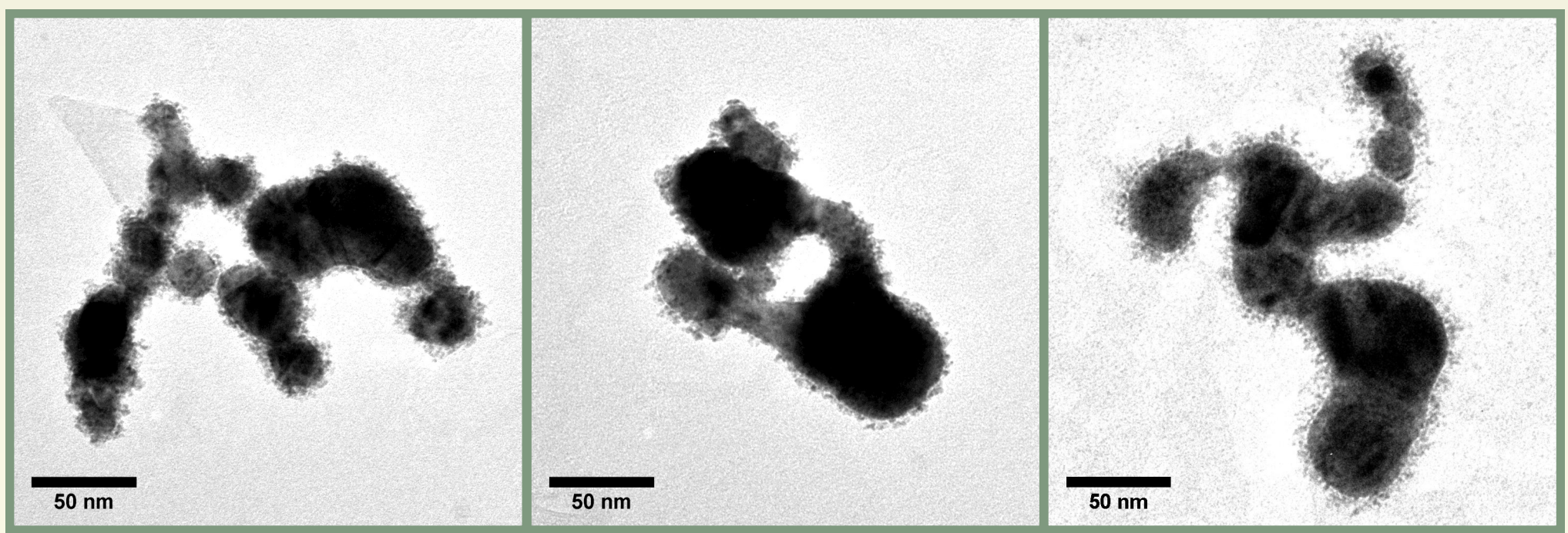
CORE-SHELL NANOSTRUCTURES



BIMETALLIC NANOFLOWERS

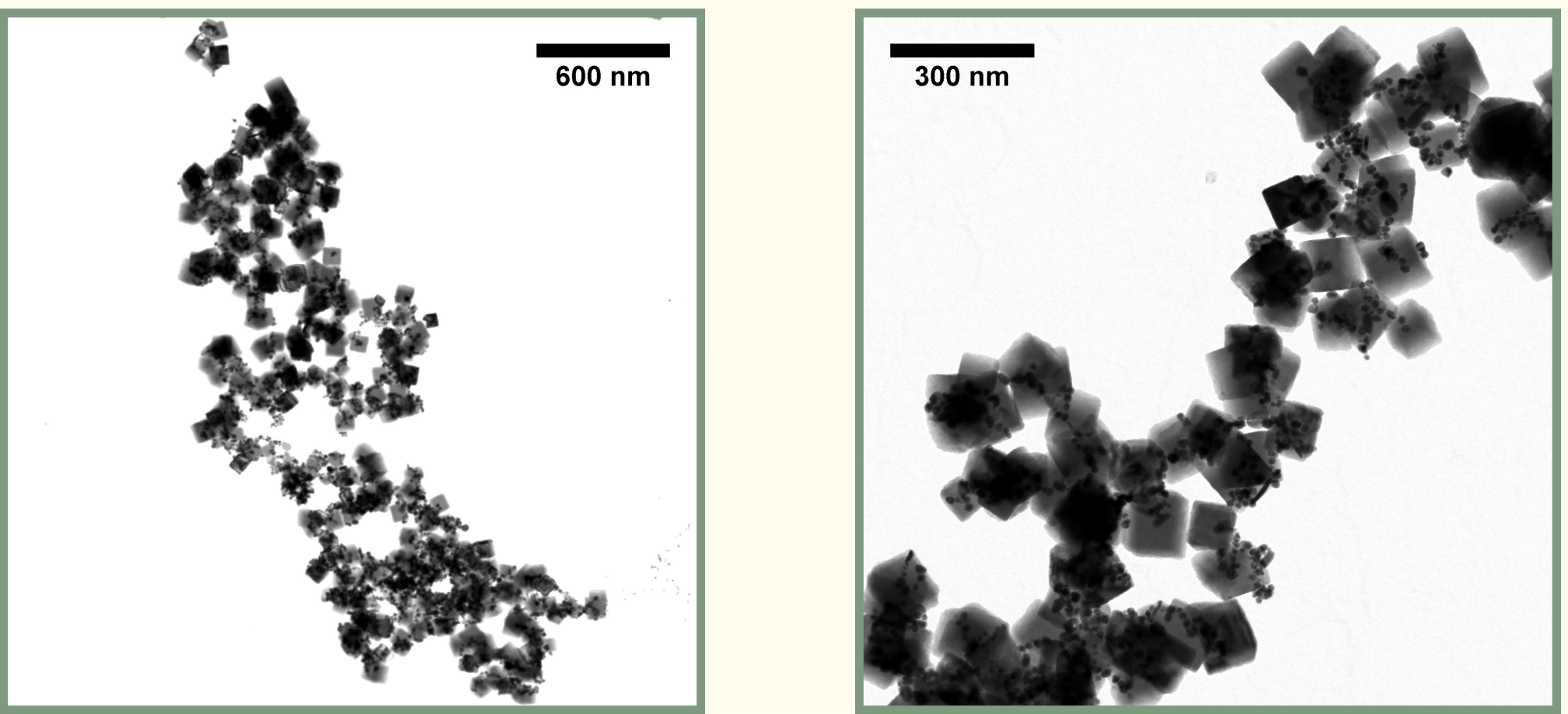
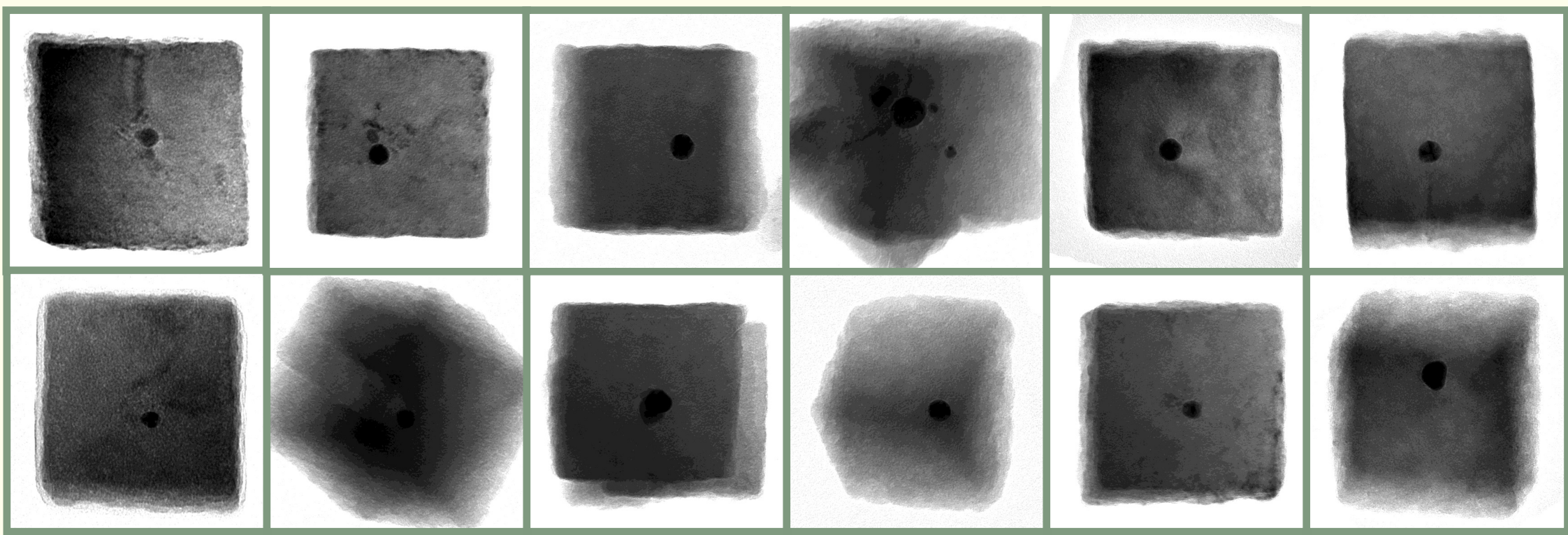
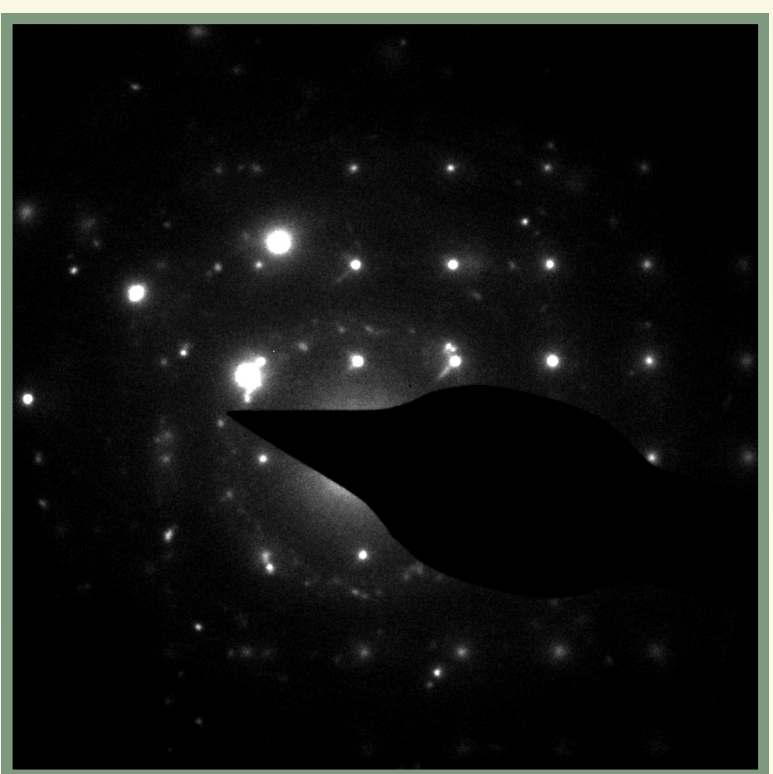
A shell of controllable thickness consisting of many individual, single-crystal PtNPs (≈ 2 nm) immobilized in a starch scaffold can be formed around single AuNP cores of varying size. The structures present a very large accessible Pt surface area.

Such shells can also be formed around anisotropic gold nanostructures and aggregates.



CUPROUS OXIDE NANOCUBES

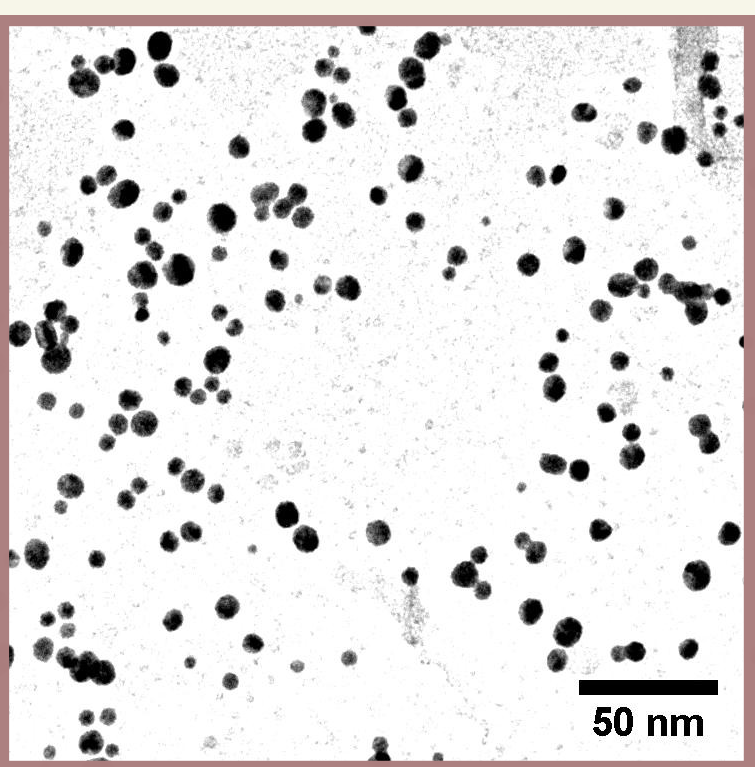
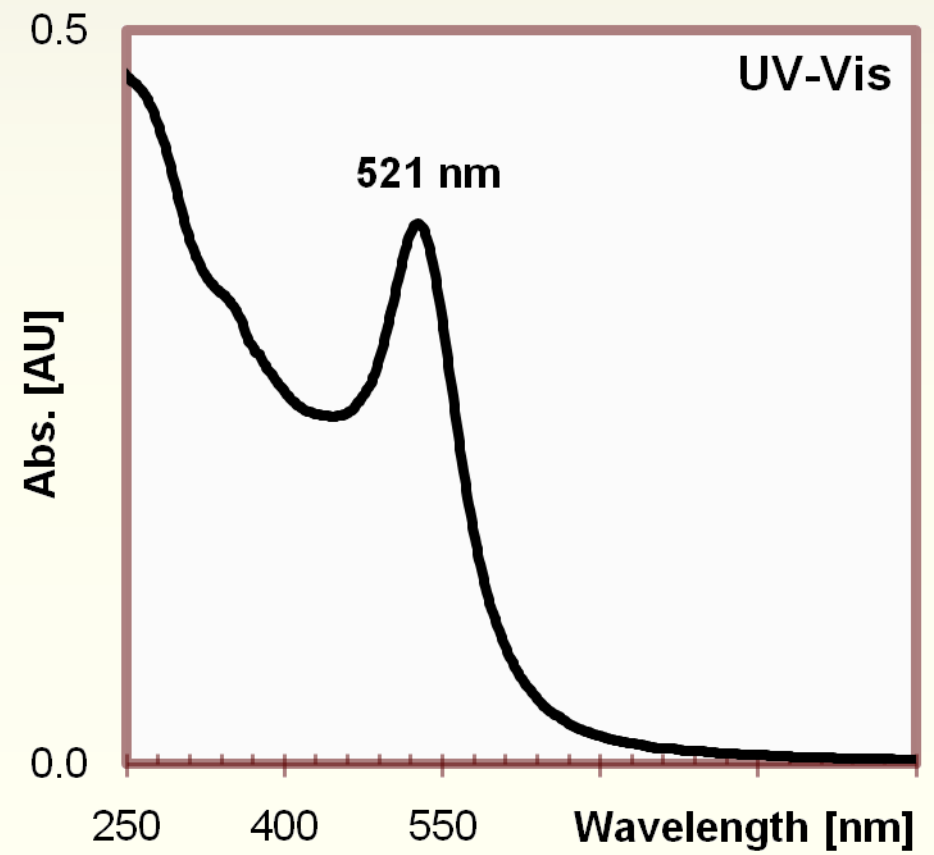
Monodisperse cubic Cu_2O shells can be formed around single AuNP cores. The 100-200 nm structures are formed directly on the TEM copper grid. The TEM micrographs of single cubes shown below all measure $150 \times 150 \text{ nm}^2$.



SPHERICAL METALLIC NANOPARTICLES

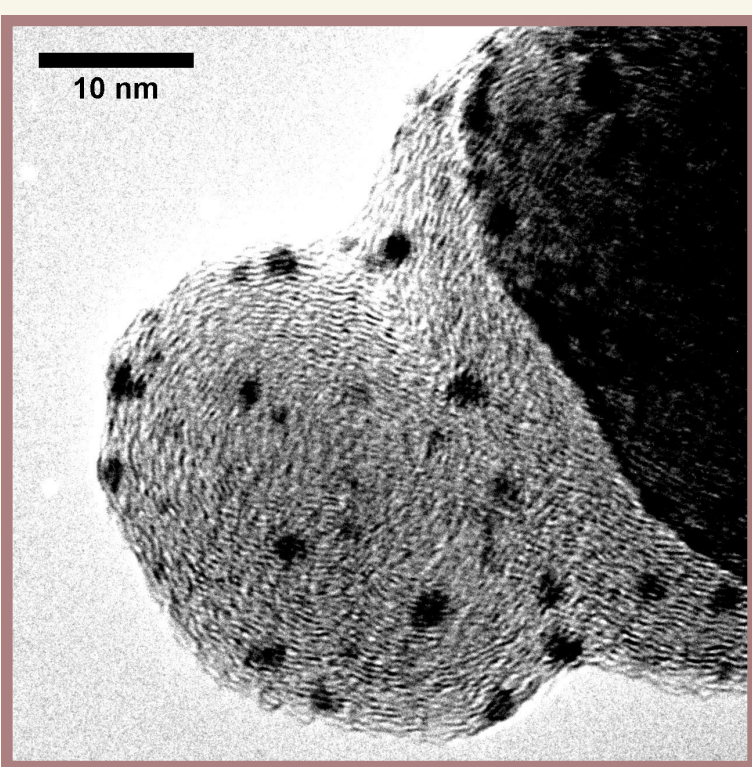
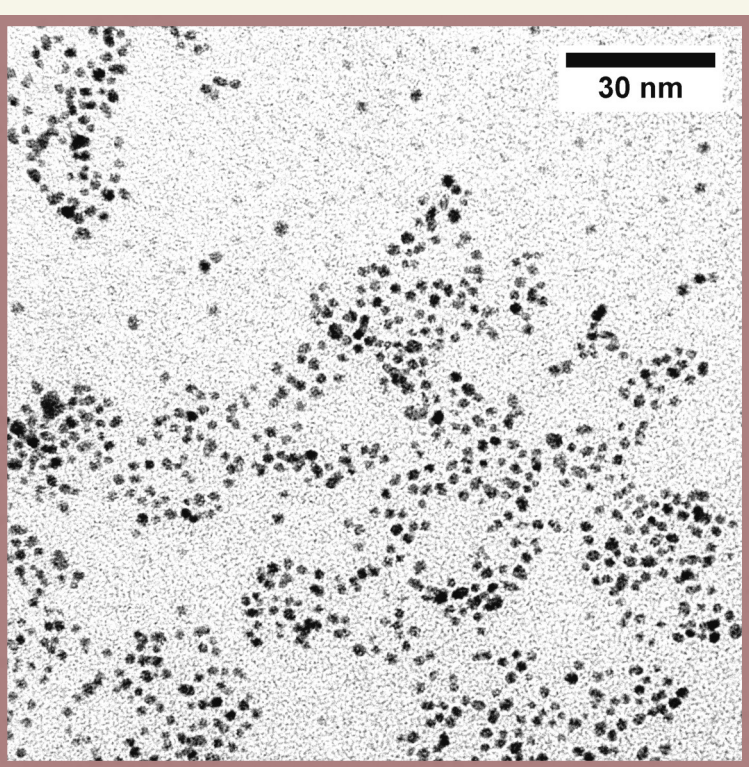
GOLD NANOPARTICLES

8 ± 2 nm spherical AuNPs are prepared at room temperature in 15 min by one particular green procedure. The colloidal solution is stable for several years.



PLATINUM NANOPARTICLES

1.7 ± 0.2 nm single-crystal spherical PtNPs can also be prepared. The PtNPs can be loaded on carbon for use in highly efficient fuel cell electrocatalysis.



WE ARE VERY OPEN TO
COLLABORATION IF ANY OF
THESE STRUCTURES ARE OF
INTEREST TO YOUR RESEARCH.

Financial support from the Lundbeck Foundation, C:O:N:T and NanoDTU is acknowledged.

We greatly appreciate the assistance from DTU CEN and Thomas W. Hansen, Jakob B. Wagner, Chris Boothroyd and Andrew Burrows.